DOCUMENT RESUME

ED 274 337 IR 012 328

AUTHOR Welker, James D.
TITLE I. I. in Science for Students in Elementary Education at the University of Alabama.
PUB DATE [Oct 85]
NOTE 19p.; Paper presented at the Annual Conference of the International Society for Individualized Instruction (New Brunswick, NJ, October 10-12, 1985).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Assignments; Continuous Progress Plan; Course Descriptions; Elementary Education; Elementary School Science; *General Science; Higher Education; *Individualized Instruction; *Mastery Learning; *Preservice Teacher Education; Study Guides

ABSTRACT

A general science course designed to meet one of the science requirements for prospective elementary school teachers at the University of Alabama emphasizes mastery learning of factual content, and is intended to provide an overview of the several areas of science that typically constitute elementary school science. This report describes this course, one of three developed at the university, which use the "Keller Approach" to provide individualized instruction (II). At the beginning of the semester, each student receives a course outline with the topics to be covered; textbook assignments; and descriptions of the course and procedures to be used for progress checks, attendance, the final examination, and final grades. The course consists of 18 units, and all units must be completed in sequence. Prior to starting work on a unit, each student receives a study guide for that unit which includes an introduction to the unit, a list of the objectives to be mastered, and a suggested procedure to ensure mastery. A quiz is given on completion of each unit. The staffing consists of one professor and five student proctors. Attendance is not required at each class period; however, the professor is present to assist students who need help and to administer unit progress checks. Final grades are based on a single comprehensive examination and two points are given for completing progress checks on time. Leaders in the class may earn bonus points by serving as student monitors. Appended materials for students include an outline of the course, the course description and procedures, the study guide for Unit 12 (Engines), and a unit progress schedule form. (Author/DJR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
James D. Welker

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

I.I. in Science for Students in Elementary Education at The University of Alabama

ED274337

I. Background.

Concerned about the absence of efforts to individualize instruction at The University of Alabama, the university's grants committee provided funds to support a one-week workshop for all interested faculty. At the conclusion of the workshop conducted by Bill Green, Georgetown University, three courses utilizing the "Keller Approach" were well into the final stages of development — one in the School of Business and Commerce; one in the Department of Psychology; and one in the Department of Elementary Education. It is the last one that I wish to describe.

II. Organization.

General Science, a course designed to meet one of the science requirements for prospective elementary school teachers, emphasizes mastery of factual content and is intended to provide an overview of the several areas of science which typically constitute elementary school science.

At the beginning of the semester, students receive a course outline of topics to be covered and textbook assignments (transparency #1), a description of the course and procedures to be used regarding Progress Checks, attendance, final exam, and final grades (transparencies #2a, 2b, 2c, and 2d).

The course is organized into 18 units which are to be completed in sequence (transparency #1). Four of the 18 units are review units. Prior to starting work on a unit, each student receives a Study Guide for that

IR013338

BEST COPY AVAILABLE

unit (transparencies #3a, 3b, 3c, and 3d) including an introduction to the unit, a list of objectives to be mastered, and a suggested procedure to ensure mastery.

Attendance at each class meeting is not required; however, the professor is present for those who need assistance with some aspect of the content. Unlike most I.I. courses, we have no graduate students assisting at this time and there are no discussion or quiz sections. A student comes to class only when help is needed, or when he/she wishes to be quizzed on the objectives.

Three forms -- Form A, B, and C -- have been prepared for each progress quiz. When a student reports to class for quizzing, one of the three forms is randomly selected and the specific form used is noted on the student's record (transparency #4). The student does not earn a grade on a Progress Quiz; however, a perfect score must be attained before the student is permitted to continue to the next unit. If the student does not attain a perfect score at the first testing, he/she will be asked to review the material for at least 30 minutes and return for a second quiz. Either of the remaining two forms of the quiz may be used for the second quizzing and, again, the one used is noted on the student's record (transparencies #5 and 6). A student may be quizzed three times on the unit objectives and if the necessary score still has not been attained, the student is asked to meet with the professor to discuss that part of the assignment causing difficulty.

At the first meeting of the class, students receive a copy of the UNIT PROGRESS SCHEDULE (transparency #7) which enables them to plan their

progress through the course so as to finish "on time" or one-to-two weeks early, and the STUDENT PROGRESS RECORD (transparency #8) which enables them to maintain a record of the work completed and points earned. Although there is no limit to the number of units that may be completed on a given day, most students limit themselves to one or two units.

III. Staff.

In the absence of graduate assistants, the class utilizes students enrolled in the course as proctors (transparency 2b). All Progress Checks for the first two units are handled by the professor; however, the first five students to complete Unit 2, are given the opportunity to serve as proctors - for extra credit as long as they remain leaders of the class. Their responsibilities include administering the appropriate Progress Checks, scoring the responses when completed, and recording the progress of each student. In order that proctors have sufficient opportunity to continue their own progress, the first few minutes of each class meeting is reserved for those proctors who wish to take Progress Checks. These are administered by the professor.

There are two advantages that come with serving as a student proctor. First, the proctor earns points toward the final grade for each week he/she serves as a proctor. The second benefit comes from the act of proctoring other students. By studying more carefully, and then repeatedly quizzing and discussing the material with other students, the proctor will come to know the material much more thoroughly. In this way, the proctor continually is being prepared for the review units and the final exam.

IV. Grades.

From the first day of class it becomes clear to students that they are not competing with others for grades in General Science (transparency 2c).

The student who wants to work for an "A" finds the grade is attainable. Emphasis is given to the importance of establishing regular study habits, the value in remaining "on schedule", and that procrastination, with the intention of "catching up" is foolhardy.

Grades are derived by means of the following point scale (transparency 2d):

1. 10 points for each unit completed on time (maximum 180 points).
2. Final examination (100 points possible).
3. Bonus points to be added to the points earned in 1 and 2 above:
   a. two points for each unit completed early, according to the Unit Progress Schedule.
   b. two points per week for serving as Student Proctor.
   c. four points for each project (maximum of two) completed as approved.
4. A student's final grade reflects the percentage of points accumulated during the course:

   Grade of A .... 90% of the 280 points (items 1 and 2 above)

   Grade of B .... 80% of the 280 points.

   Grade of C .... 70% of the 280 points.

   Grade of D .... 60% of the 280 points.

   Grade of F .... Less than 60% of the 280 points.

Transparency 1

CEE 304: GENERAL SCIENCE

TEXTBOOKS: (A) Developments in Elementary School Science (a report of seven regional conferences for school administrators).

(B) Elementary School Science and How to Teach It, 5th edition. By Blough and Schwartz.

UNIT OF STUDY	COMPLETION DATE	READING ASSIGNMENT
1. Orientation to PSI Approach	_____	Study Guide and Article by Keller
2. History of Elementary Science	_____	Textbook (A), pp. 1-11
3. Five Elementary School	_____	Textbook (A), pp. 28-36
4. Review of Units 1-3	_____	
5. Molecules and Atoms	_____	Textbook (B), pp. 477-483
6. Chemical Change	_____	Textbook (B), pp. 483-492
7. Heat: Its Effects and Uses	_____	Textbook (B), pp. 506-522
8. Nuclear Energy	_____	Textbook (B), pp. 536-545
9. Review of Units 5-8	_____	
10. The Metric System	_____	Handout and Cassette Tapes
11. Simple Machines	_____	Textbook (B), pp. 559-569
12. Engines	_____	Textbook (B), pp. 569-570; and 2 articles to be provided.
13. Review of Units 10-12	_____	
14. Magnetism	_____	Textbook (B), pp. 586-592
15. Introduction to Electricity	_____	Textbook (B), pp. 592-598
16. Generating Current Electricity	_____	Textbook (B), pp. 598-604
17. Motors: Electricity for Heat and Light	_____	Textbook (B), pp. 604-606
18. Review of Units 14-17	_____	

Transparency 2a

CEE 304 -- GENERAL SCIENCE

COURSE DESCRIPTION AND PROCEDURES

1. Description.

This course, CEE 304, has been redesigned in an attempt to provide for greater individualization in your program of study. The approach used here is known as the "Keller Plan", the "Keller Approach" and the "Personalized System of Instruction". Although PSI courses are rare on this campus, the approach is being used in more than 700 colleges and universities in this country (M.I.T., Harvard, Tennessee, Georgia, Arizona State, and University of California, to name a few) and in many foreign universities. A majority of students who enroll in PSI courses have indicated an overwhelming preference for this approach over more conventional methods of instruction.

The PSI approach, regardless of where it is being used, has certain recognizable features. You will learn of these later, so I shall not bother you with them at this time; however, this course will probably be quite different from most of your college courses. I think you will find it to be an enjoyable change, and hope you will feel more comfortable with science as a result of your experiences in this course.

This course consists of 18 units. All units must be completed in sequence, starting with unit 1 and ending with unit 18. Prior to starting to work on a unit you will receive a Study Guide consisting of an introduction to the unit, a list of objectives to be mastered, and a procedure to be followed in working on the unit. When you complete a unit you are to take a quiz on the unit to determine if you have mastered the objectives. The unit quizzes are described in more detail in Part 3.

2. The Staff.

The staff for this course will consist of the professor and as many as five student proctors. During the first week of the course, all Progress Checks will be handled by the professor; however, the first five students to complete UNIT 2 will be given the opportunity to serve as proctors. The proctors will distribute the proper unit Progress Check sheet, score the responses when completed, orally quiz the student when necessary, and record the progress made.

A student may continue serving as proctor as long as he/she is among the leaders in number of units completed; however, it is expected that the make-up of the proctor team will change occasionally as other students move into the lead.

In order that proctors are given sufficient opportunity to continue their progress, the first few minutes of each scheduled class session will be reserved for those proctors who wish to take progress checks. These will be administered by the professor.

There will be two advantages that will come with serving as a student proctor. First, the proctor will earn two points toward the final grade for each week he/she serves as proctor. The second benefit comes from the very act of proctoring other students. By studying more carefully, and then repeatedly quizzing and discussing the material with other students, the proctor will come to know the material much more thoroughly. In this way the proctor is continually preparing himself/herself for the review units and the final exam.

Transparency 2c

3. Grades.

You should be able to get an "A" in this course. In fact, as you will discover in UNIT 1, a majority of students enrolled in PSI courses receive "A's", with a slightly lesser number earning "B's". However, a word of caution -- do not expect this to be a "snap course", for you will have much work to do. It will be hard work, but the grade you receive will be the grade that you have earned, since you will not be competing with your classmates for the "good grades".

It will be important that you establish regular study habits. A specific time set aside each day to work on your units will be very helpful. You will learn that it will be unwise to postpone your work, expecting to "catch up" by "cramming" at the last minute. Time will be a limiting factor. Usually, you will have time to pass one unit Progress Check per day; occasionally, you might get through two checks successfully. So don't count on "catching up" after several days of doing nothing.

You will not receive a grade on the unit quiz, but you must obtain a perfect score before continuing on to the next unit in the sequence. In this way the quiz serves as a "progress check". If your score indicates you have not mastered the unit's objectives you will be asked to review the material and return at a later time (no sooner than 30 minutes, but at the next class session, if you wish) to re-take the Progress Check. If you do not make a perfect score on the first or second testing, you may take the Progress Check a third time to obtain the score necessary to proceed to the next unit; however, if a perfect score is not obtained at the third attempt, you are asked to meet with the instructor to discuss that part of the assignment causing difficulty.

Transparency 2d

This is the way your grade for this course will be calculated:

1. Each unit completed on schedule is worth 10 points.

   18 units x 10 points ..... _____

2. Final Examination (100 maximum)..... _____

3. Bonus Points.

   (a) 2 points for each unit completed early..... _____

   (b) 2 points per week for serving as proctor.... _____

   (c) 4 points per approved project

   completed as agreed (maximum of two) ..... _____

   TOTAL POINTS EARNED _____

4. The grade scale to be used is that used by the university as a whole. Since a student should have the opportunity to work for an "A" without relying on extra credit work, the point values listed here are based on a maximum of 280 points. (The maximum possible from the unit points and the final examination.)

5. You will have earned a grade of --

   A -- if your point total falls between 280 and 250 (90% of the 280 points possible).

   B -- if your point total falls between 249 and 224 (80% of the 280 points possible).

   C -- if your point total falls between 223 and 196 (70% of the 280 points possible).

   D -- if your point total falls between 195 and 168 (60% of the 280 points possible).

   F -- if your point total falls below 168.

Transparency 3a

Study Guide

UNIT 12: ENGINES

INTRODUCTION.

In this age of the "motor", the powered lawnmower, and the speed boat, such terms as spark plug, carburetor, crankshaft, rpm, fuel mixture and compression, are included in the functional vocabulary of many elementary school children. It is necessary, therefore, that the teachers of these children possess a vocabulary of basic terminology and an understanding of engines. This unit is designed to help provide this information.

OBJECTIVES.

When you have completed UNIT 12 you should be able to

1. Define: carburetor, spark plug, intake stroke, compression stroke, power stroke, exhaust stroke, piston, cylinder, connecting rod, crankshaft, and valve.
2. Explain what is meant by the term INTERNAL COMBUSTION ENGINE.
3. State in order the four strokes of a 4-cycle engine and explain briefly what happens during each.
4. Identify, with the aid of a cut-away lawn mower engine, these parts: piston, cylinder, connecting rod, crankshaft, intake valve, exhaust valve, spark plug.
5. Explain how a gasoline engine differs from a diesel engine.
6. State the differences between a 2-stroke and a 4-stroke gasoline engine, and list two examples of each.
7. Explain, with the assistance of a diagram, how a turbojet engine works. Include in your explanation the function of the compressor, combustion chamber, and the turbine.

8. Explain, with the aid of a classroom model of a steam engine, how the engine works. What factor determines the amount of energy produced?
9. Explain how the steam turbine differs from the steam engine.
10. State the advantages and disadvantages of steam engines, gasoline engines, and diesel engines.
11. Identify from diagrams a jet engine, turbojet engine, and a rocket engine.

PROCEDURE.

1. Read pages 569-570 in your textbook. This is a brief treatment of engines, so complete this reading before going to the two articles listed below.
2. Read the articles: "How is Steam Used to Run Machines?" and "How is Exploding Gas Used to Run Machines?"

   These articles may be obtained from the proctor. Read one article, answer the questions, then return the article to the proctor before checking out the next one.
3. Complete the following Study Questions:
   a. What is the principle on which the steam engine and steam turbine work?
   b. How is power derived in the gasoline engine?

   Read the article "How is Steam Used to Run Machines?". Answer the next four questions and complete the self-testing exercises at the end of the article, and then return the article to the proctor.
   c. What two factors determine the amount of energy steam can give to an engine?
   d. With the aid of a classroom model of a steam engine, explain to the instructor (or proctor) how the engine works. Include in your

explanation, the function of the boiler, flywheel, piston and connecting rod. These parts should be identified on the model.

e. How does the steam turbine work?

f. How efficient is the steam turbine? How efficient is the steam engine?

Read the article "How is Exploding Gas Used to Run Engines? Answer the next eight questions and the self-testing exercise at the end of the article. Return the article to the proctor after you have answered the questions.

g. How is fuel in the internal combustion engine caused to explode?

h. Define the terms: internal combustion engine, carburetor, spark plug, intake stroke, compression stroke, exhaust stroke, piston, cylinder, crankshaft, connecting rod, and valve.

i. Examine the cut-away lawn mower engine on display in the classroom. Be able to identify the following parts: piston, cylinder, spark plug, intake valve, exhaust valve, connecting rod, and crankshaft.

j. What function does the electric motor play in the starting of your car?

k. Approximately how many gallons of air are needed to ignite each gallon of gasoline in your car? (If the engine is getting too much gasoline, we say the mixture is "too rich"; if it is getting too little gasoline, the mixture is "too lean".)

l. List two differences between 4-stroke and 2-stroke gasoline engines. State two uses for each type of engine.

m. What is the efficiency of the gasoline engine? What is the efficiency of the diesel engine? How do these compare with the efficiency of the steam engine?

Transparency 3d

n. A diesel engine is much heavier than a gasoline engine of approximately the same power. Explain why this is necessary.

4. When you have completed the study questions and think you have mastered the ten stated objectives obtain a copy of Progress Check FORM (A) for UNIT 12 from the proctor.

Transparency 4

UNIT 12 -- PROGRESS CHECK FORM (A)

1. Define: piston, intake stroke, connecting rod, valve.

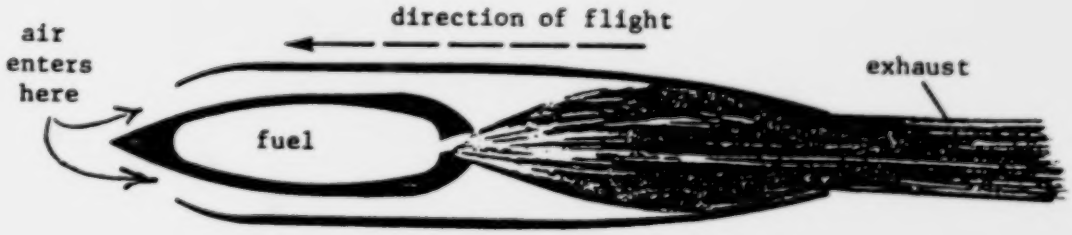
2. Explain what is meant by internal combusion engine.

3. Describe two ways in which the diesel engine is different from the gasoline engine.

4. Which one of the following is used to provide the power in the conventional car?

   (a) 2-stroke gasoline engine
   (b) 4-stroke engine
   (c) diesel engine
   (d) gas turbine

5. Which one of the following does the diagram represent: jet engine, turbojet engine, 2-cycle engine, 4-cycle engine, diesel engine or rocket? On what features do you base this decision?



6. Explain orally to the instructor (or proctor) how this engine works.

7. Of what importance is the starting motor for your car engine?

8. What is the function of the carburetor in your car?

9. Accompany the instructor (or proctor) to the cut-away lawn mower engine. Identify correctly three of the following parts upon request: spark plug, intake valve, exhaust valve, piston, cylinder, connecting rod, crankshaft.

10. Describe the construction and operation of a steam turbine or a gas turbine.

Transparency 5

UNIT 12 -- PROGRESS QUIZ FORM (B)

1. Define: carburetor, power stroke, crankshaft, cylinder.

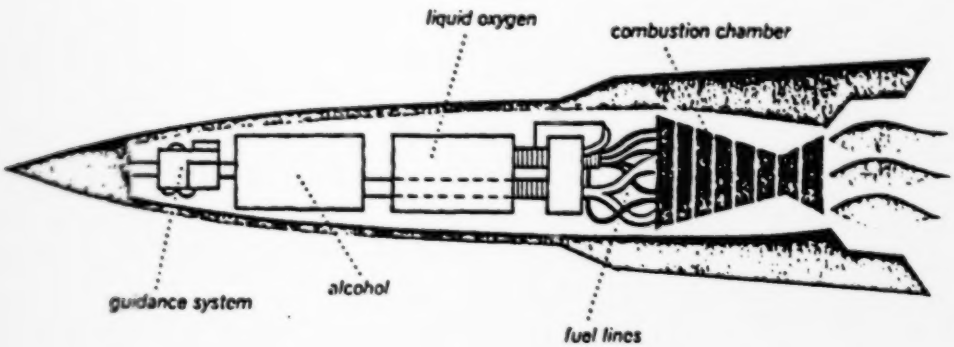
2. List in the correct order the strokes of the 4-cycle engine.

3. What is the maximum efficiency of gasoline engines? What is the maximum efficiency of diesel engines?

4. Explain how a 2-stroke engine differs from a 4-stroke engine.

5. What is the function of the spark plug in gasoline engines?

6. Which one of the following does the diagram represent: jet engine, turbojet engine, 2-cycle engine, 4-cycle engine, diesel engine, rocket engine.



7. Explain orally to the instructor (or proctor) how this engine works.

8. Approximately how many gallons of air is needed to mix with one gallon of gasoline?

9. State two advantages and two disadvantages of the gasoline engine.

10. Accompany the instructor (or proctor) to the classroom model of the steam engine. Explain how the steam engine works, including in your explanation the identification and function of each of the following parts: boiler, flywheel, piston, cylinder, connecting rod.

Transparency 6

UNIT 12 --- PROGRESS QUIZ FORM (C)

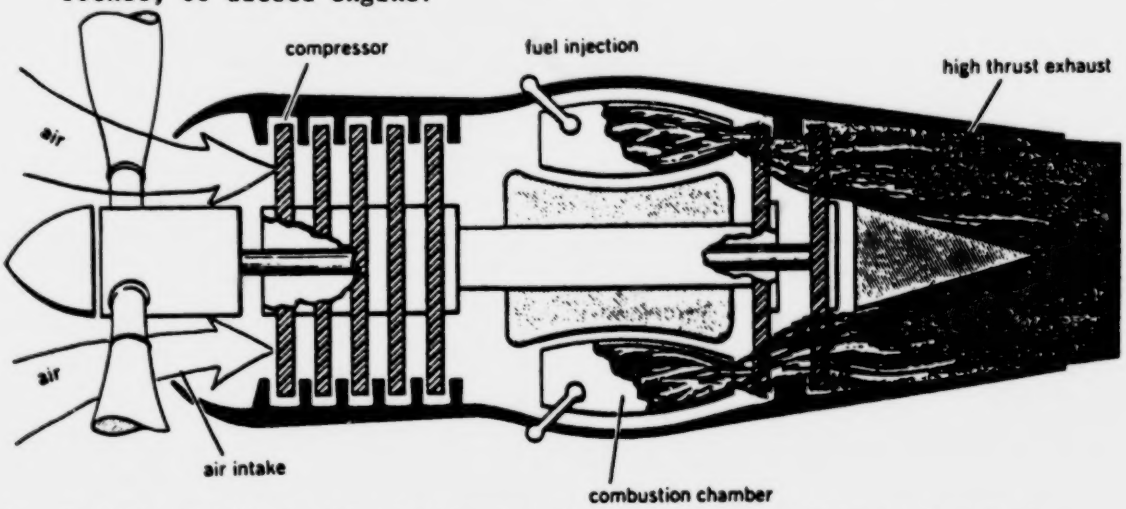
1. Define: spark plug, compression stroke, exhaust valve.

2. What two kinds of fuel are used in internal combustion engines?

3. A diesel engine is usually heavier than a gasoline engine with the same power. Explain this.

4. (a) Describe two uses for 2-cycle gasoline engines.
   (b) Why is the 2-cycle engine used rather than a 4-cycle engine?

5. Which one of the following does the diagram represent:
   jet engine, turbojet engine, 2-cycle engine, 4-cycle engine,
   rocket, or diesel engine?



6. Explain orally to the instructor (or proctor) how this engine works.

7. What is meant when the air-gasoline mixture is said to be "too rich"?

8. State two advantages and two disadvantages of the steam engine.

9. Accompany the instructor (or proctor) to the cut-away lawn mower engine. Identify correctly three of the following parts upon request: spark plug, intake valve, exhaust valve, piston, cylinder, connecting rod.

10. What is the purpose of the pistons in the internal combustion engine?

Transparency 7

CEE 304: GENERAL SCIENCE

UNIT PROGRESS SCHEDULE

CLASS DATE		RATE OF COMPLETION			
		"ON TIME"	1 WEEK EARLY	2 WEEKS EARLY	3 WEEKS EARLY
Aug.	27	---	---	---	---
	29	Unit 1	Unit 1	Unit 1	Unit 1
Sept.	3	2	2	2	2
Sept.	5	3	3	3	3
	10				4
	12	4	4	4	5
	17	5	5	5	6
	19	6	6	6	7
	24			7	8
	26	7	7	8	9
Oct.	1	8	8	9	
	3	9	9		10
	8			10	11
	10	10	10	11	12
	15	11	11	12	13
	17	12	12	13	14
	22	13	13	14	15
	24		14	15	16
	29	14	15		17
	31	15		16	18
Nov.	5		16	17	19
	7	16	17	18	20
	12	17	18	19	21
	14	18	19	20	
	19	19	20	21	
	21				
	26	20	21		
Dec.	3				
	5	21			

Transparency 8

Name: _____

CEE 304: GENERAL SCIENCE

STUDENT PROGRESS RECORD

DATE	UNIT QUIZ COMPLETED	SERVED AS PROCTOR	TOTAL POINTS EARNED
Aug. 27	____	____	
29	____	____	____
Sept. 3	____	____	
5	____	____	____
10	____	____	
12	____	____	____
17	____	____	
19	____	____	____
24	____	____	
26	____	____	____
Oct. 1	____	____	
3	____	____	____
8	____	____	
10	____	____	____
15	____	____	
17	____	____	____
22	____	____	
24	____	____	____
29	____	____	
31	____	____	____
Nov. 5	____	____	
7	____	____	____
12	____	____	
14	____	____	____
19	____	____	
21	____	____	____
26	____	____	
Dec. 3	____	____	
5	____	____	

Total Points _____